PATENT SPECIFICATION

Appl[illegible] Date: Dec. 19, 1931. No. 15,599/31. [illegible]9,535

Complete Accepted: March 23, 1933.

COMPLETE SPECIFICATION.

Improved Heat-insulated Storage Chambers particularly for Preserving Foodstuffs.

I, JAMES ANSTRUTHER HUGHES BOWMAN, of Casilla 117, Vina del Mar, Republic of Chile, British Subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to heat-insulated storage chambers or cabinets, particularly for foodstuffs, of the kind in which the storage chamber is surrounded or partly surrounded by an outer space adapted to be connected to a vacuum pump or exhauster so that air can be exhausted either at will or automatically from said space, the storage chamber being also provided with means for connecting it to the pump or exhauster or to an independent pump or exhauster and with means for admitting air to the partially or wholly evacuated storage chamber.

It is known in a storage chamber of the above kind to provide means for admitting air to the surrounding wholly or partially evacuated space through the storage chamber by breaking the vacuum in the latter.

According to the present invention, there is provided means which will permit air to be admitted to the wholly or partially evacuated space surrounding the storage chamber while maintaining the vacuum in the storage chamber.

Thermally responsive means may be provided in the evacuated space surrounding the storage chamber in order to automatically start the pump or exhauster which is connected to the surrounding evacuated space, in the event of the temperature therein attaining or exceeding a predetermined temperature, and similar means may be provided in the storage chamber to automatically start the pump or exhauster connected to said storage chamber when the temperature in said chamber rises to or above a predetermined temperature.

The cabinet comprises an inner wall forming the storage chamber and an outer wall spaced from and surrounding or partly surrounding the inner wall, the intermediate space being more or less evacuated by connecting it to an electrically, hand or otherwise operated pump or exhauster and the outer wall being fitted with an air inlet for directly admitting air through said outer wall to said intermediate space. The storage chamber is adapted to be connected to the same pump or exhauster or to an independent pump or exhauster. Between the inner and outer walls there may be an intermediate wall, the space between the intermediate and outer walls either enclosing insulating material or being evacuated, while the space between the intermediate wall and the storage chamber is evacuated.

The inner and/or intermediate walls are preferably of a good heat-conducting material and the outer wall may consist of one or more plies or layers of insulating material and/or metal.

The accompanying drawings illustrate various manners of carrying the invention into effect.

Fig. 1 is a diagrammatic vertical sectional view through a storage cabinet or chamber.

Fig. 2 shows in plan view an inner box or chamber and Fig. 3 a plan view of the cover or lid for same.

Fig. 4 is a detail sectional view showing the pump or exhauster connection and the air admission cap.

Figs. 5, 5a and 5b are sectional views showing various methods of forming the edges of the inner chamber walls and/or the intermediate walls.

Figs. 6, 7 and 8 show a method of securing the cover or lid of the chamber or cabinet.

Figs. 9 and 10 are diagrammatic vertical and horizontal sectional views through another form of the invention.

Fig. 11 is a diagrammatic horizontal sectional view of an alternative form of construction of the type of cabinet shown in Figs. 9 and 10.

Figs. 12 and 13 show two methods of admitting air to the inner or intermediate chambers.

Referring firstly to Figs. 1 to 8 of the drawings, 1 designates the inner or actual storage chamber formed by an inner wall or box 2 preferably of good heat-conduct-

ing material and having an airtight cover or lid. Around the wall 2 is a space 4 formed by an outer wall 5 and intermediate wall 3 as shown in Fig. 1, the wall 5 being formed preferably of one or more plies of heat-insulating material. The intermediate wall 3 may be omitted. The box 2 is supported within the outer box 5 or intermediate wall 3 by means of spacing pieces or bars 6 of heat-insulating material or metal covered by insulating material, the spacing pieces or bars 6 being preferably perforated to allow the compartments of the space 4 around the outside of the box 2 to be interconnected with one another.

The outer wall 5 and/or intermediate wall 3 of the cabinet may be of pressed cork board, artificial resin, porcelain or other suitable material or, if desired, they may be of reinforced glass, celluloid, aluminium or other metal or metal alloy. The walls 5 and/or 3 may be of any thickness and may be lined internally with waterproof paper or with a coating of an artificial resin which is waterproof and greaseproof. Any of the above mentioned materials may be combined with another material, e.g. walls of artificial resin or pressed wood fibre may be externally or internally lined with galvanized iron sheet or tin plate, or with cork board. All the walls may be wholly or partly coated with waterproof or heat-insulating paint or composition.

The edges of the inner box 2 and/or intermediate wall 3 may be bound or covered by strips 7 (Fig. 5) of airtight material and the edges of the pieces of material forming the sides, top and bottom of the inner box 2 may be coated with a covering of rubber or the like so that when they are pressed together, the edges form an air-tight joint, or they may be soldered or held together by other means. The edges of the box 2 may be formed as shown in Fig. 5, in which the edge of one side 8 is made convex so as to fit into the concave edge of the adjoining side 9 of the box to form an air-tight joint. The edges, instead of being formed as shown in Fig. 5, may be formed as shown in Figs. 5a or 5b, the side 9 in Fig. 5a being formed at its edge with a rebate or recess 9a into which fits a projection or tongue 8a on the side 8. In Fig. 5b the side 8 is formed at its edge with a rebate or recess 8b into which fits the edge of side 9. The two sides 8 and 9 may be held together by means of screws or nails 8c and the abutting surfaces of the edges may be lined with rubber or the like to ensure an airtight joint. Instead of the recesses having right-angled corners, they may be curved and the edges of the projections or tongues may be rounded accordingly. The walls of the box may be tightly secured together at the joints by any known means.

The inner box 2 is fitted, as shown in detail in Fig. 4, with a pump or exhauster connection 17, which may be fitted to the cover or lid or top of the box, the connection being externally screw-threaded so as to be disconnectable from the pump or exhauster (not shown). The connection 17 is provided with an automatic check valve, comprising a ball 18 which closes downwards under atmospheric pressure on to a valve seat 19 and opens against a grid or open spider 20 which keeps the ball in place. The inner end of the connection 17 below the valve seat 19 is perforated with holes and provided with grids 21 to allow the air to pass from the chamber out through the valve when evacuating the chamber 1.

Air is admitted to the chamber 1, when it is desired to open the box, by unscrewing a cap 22 screwed into a screw-threaded connection 23 in the top or lid of the box 2. Both the pump connection 17 and cap 22 are provided with rubber washers or the like to insure an airtight connection.

The evacuated space 4 is also provided with an exhauster connection 17 and an air admission connection 23 and cap 22.

The connection between either of the connections 17 and the exhauster may be provided with a pressure gauge or thermometer in order to ascertain when to stop exhausting air from the chamber 1 or space 4, but when the box 2 and space 4 are provided with thermometers 73 and 74, as shown in Fig. 1, neither the pressure gauge nor the thermometer is necessary.

The box 2 may be provided with removable vertical or horizontal partitions 24 (Fig. 2). These partitions may be held in position by grooves or projections 25 inside the box, and are perforated to allow the air inside the box when not evacuated to circulate freely.

The top 26 of the outer wall or box 5 preferably forms a lid as in Fig. 1, to allow access to the inner wall or box 2 and to the surrounding evacuated space 4.

In the storage cabinet shown in Fig. 1, the exhauster connection 17 and air inlet connection 23 and cap 22 are fitted in the cover or lid 75 to the box 2 and similar connections 17 and 23 with cap 22 are fitted to the lid 76 in the intermediate wall 3 surrounding the space 4. The top of the outer wall 5 may be provided with a lid immediately above the lid 76 in the intermediate wall 3 instead of having the top 26 removable as hereinbefore described. Thermometers 73 and

74 are provided in the lid and 76 to indicate the temperature within the chamber 1 and the space 4 and the inner ends of the connections 17 and 23 may be provided with wire grids or metal covers to prevent food carried in the chambers inadvertently entering the ends. In Fig. 1 there is no space between the intermediate wall 3 and outer wall 5.

The top of the box 2 may be held down as shown in Figs. 2 and 3 by means of screws and spring washers (not shown) which pass through holes 14 in the top 11 into internally screw-threaded holes 15 in sockets or projections 16 on the sides of the box. The holes 14 may be bushed with metal and the top of the box may have grips or handles for lifting it off when opening the box.

Another construction for securing the lid 11 is shown in Figs. 6, 7 and 8 in which the lid is hinged to one side of the box and is secured at the other side by means of one or more hinging screws 70 adapted to enter notches 71 in or formed on the lid 11 where they are secured by means of nuts 72 adapted to screw down on to the lid 11.

The boxes 2 hereinbefore described may be provided with a tap, extending to the outside of the cabinet, to permit the storage of liquid in the chamber 1, and the evacuation thereof from said chamber 1.

Referring now to Figs. 9 to 11 of the drawings, 33 designates the inner storage chamber formed by an inner wall 34 preferably of thin copper sheet provided with an airtight door 34a of non-conducting material. The storage chamber 33 may be fitted with shelves or divisions. Around the wall 34 is a space 35 formed by a shell 36. Surrounding the shell 36 and spaced therefrom is an outer casing 37 and the space between is filled with asbestos 38 or other non-conducting filling. Supports 39 of metal or metal covered with non-conducting material, bridge the space 35 at intervals, the supports being perforated to provide communication between the several parts of the space 35. An outer air-tight door 40 is fitted to the casing 37. this outer door being preferably constructed with inner and outer walls 40a and 40b enclosing a filling 41 of non-conducting material. The casing 37 and inner shell 36 are formed to provide a recess in the cabinet wall into which the door 40 is fitted. The space 35 may, however, be continued between the door 40 and door 34a, as shown in Fig. 11, in which case door 34a may be of thin copper sheeting or other conducting material. The door 34a shown in Fig. 10 may be omitted so as to allow direct admission to the storage chamber 33 when the air-tight door is open. The outer wall and/or its door may be made of asbestos enclosed between inner and outer shells of sheet metal, or they may be made of asbestos board or any suitable non-conducting material. For example, the wall or door may have an outer shell and inner lining of porcelain or enamelled sheet metal with a space between the outer shell and inner lining, said space being wholly or partly filled with asbestos, wool, felt, asphalted felt, cork-board, wood, or other non-conducting filling with or without air spaces.

Pump connections 42 and 43 open into the chamber 33 and the space 35 respectively, the connections leading through pipes 42a and 43a to a common pump connection 44 of a pump or exhauster driven by an electric motor 45 placed in a chamber 57 conveniently beneath the storage chamber. The pump connection 44 is fitted with an automatic check valve 46 which opens downwards. The valve 46 closes a valve seat 47 when pressed upwards by atmospheric pressure in the pump connection 44 when the pump or exhauster is not in operation or is disconnected from the connection 44. The valve 46 may be of the ball valve type and rests when open on a grid or open spider 58 fitted in the connection 44 beneath the seat 47 which may be fitted with a renewable airtight washer of any suitable type.

The connection 43 which is connected to the pump connection 44 by a pipe 43a may be disconnected from the exhauster or pump by closing a valve 48 in the pipe 43a. The temperatures of the chamber 33 and space 35 can be maintained equal, by opening the valve 48 in the pipe 43a and thus interconnecting the chamber and the space 35 through the pipes 42, 42a, 43a and 43. The connection 42 is also provided with a two-way valve 49 adapted to control the admission of air through an inlet pipe 50 to the chamber 33 so that the door 34a can be opened. By turning the valve 49 through an angle of 180°, the air inlet 50 is closed and the chamber 33 is, by opening a valve 59, placed in communication with the pump or exhauster through the pipe 42a and connection 44. Air may also be admitted to the space 35 when desired by opening the valves 48 and 59 when the valve 49 is admitting air to the connection 50, the air passing through the pipes 42a, 43a and connection 43 into the space 35. When it is desired to exhaust both chambers 33 and 35, it is only necessary to close the air inlet pipe 50 by turning the valve 49 through 180°. If however it is only desired to exhaust the space 33, the

valve 48 is closed which cuts off the communication between the space 35 and the pump or exhauster. The chamber 33 can be disconnected from both exhauster and air by means of the valves 59 and 49 or can be connected to either air or exhauster by said valves. Instead of air being admitted to the space 35 through the air inlet pipe 50 and pipe 42a, the connection 43 may also be provided with a two-way valve adapted to independently control the admission of air through an air inlet pipe to the space 35. All the valves may be fitted with control rods which may be interconnected, the rods extending to the outside of the cabinet so that said valves can be operated without entering the chamber 57 in the bottom of the cabinet.

Instead of admitting air to the chamber 33 and space 35 by means of the connections 42 and 43, the doors 34a and 40 may be provided with air admission connections 23 and caps 22, as shown in Fig. 4, for admitting air when it is desired to open the doors, or they may be provided with one or other of the devices illustrated in Figs. 12 and 13, in which a plug 78 (Fig. 12) or rubber stopper 79 (Fig. 13) is adapted to cover and uncover an aperture 80 in the door. The plug and stopper are fitted on the end of a screwed spindle 81 adapted to rotate in a screwed collar or nut 82 fitted to a bridge member 83 on the outside of the door, the spindle 81 being rotated by means of a handle 84. The plug 78 and the recess in or face of the aperture 80 in the door may be lined with rubber around the aperture 80 so that when the plug or stopper abuts against same it makes an airtight joint. The plug or stopper may however be moved by means of a cam lever or the like adapted to open and close the opening 80 by operating the lever towards and away from the door.

A thermometer 52 fitted to the space 35 and a thermometer 53 fitted to the chamber 33 indicate the termperatures in these chambers. A pressure gauge 51 is provided for indicating the pressure in space 35.

In order that the pump or exhauster may operate automatically to maintain the temperature desired in the chamber 33 and the space 35, both are fitted with an automatic thermal switch 54 adapted to close the electric power circuit 55 of the electric motor 45 driving the pump or exhauster when the temperature in the chamber 33 or the space 35 reaches a predetermined degree, which need not necessarily be the same in each chamber. The switches 54, which are adjustable, may comprise a thermometer inserted in the electric circuit [illegible] the mercury or other substance of the thermometer when it reaches a predetermined height in the thermometer tube forming a connection between the two terminals of the electric circuit 55. A switch 56 may be inserted in the circuit so that the automatic switches 54 may be disconnected from the motor 45.

Where, as in Fig. 10, the surrounding space 35 does not continue behind the door 40 and where there is no access to the space 35, a small airtight door may be provided in the wall 34 or outer casing 37 and shell 36 to provide access to the automatic switch 54 in the space 35.

The storage cabinet or chamber may be exhausted of air by a hand operated pump or exhauster connected in suitable manner to the valves and connections on the chamber.

The casing 37 and/or inner shell 36 may be omitted and the outer and/or inner surfaces of the insulation coated with an insulating waterproof paint or waterproof paint composition.

The cabinet may be made portable by mounting it on rollers or wheels.

An ice-making unit may be built in the cabinet, preferably in the upper part of the space 35 or inner chamber 33 or it may be attached to the outside of the casing 37. This unit may consist of a small chamber 60 provided with an airtight door and having a pipe connection 61 to the exhauster 45 so that the temperature in the ice-making unit can be lowered below that in the space 35 or chamber 33, if desired. An air admission inlet and tap 62 may be provided on the pipe 61 to allow air into the chamber 60 from the space 35 or chamber 33, and a stop valve 63 can be fitted to cut off the exhauster from the chamber 60 when desired. The ice-making unit may contain suitable freezing trays and/or shelves. It may also be provided with a thermometer and an adjustable automatic thermal switch similar to the type fitted in chamber 33 and space 35 and for the same purpose. The ice making box may also be provided with an air-admission connection 23 and cap 22 of the type shown in Fig. 4 for admitting air when it is desired to open the door, particularly if the ice-making unit is attached to the outside of the outer casing 37. The pipe 61 may be either led down inside the chamber 33 and space 35 to the exhauster 45 or may be carried directly out through the wall 37 and thence down to the exhauster.

The chamber 33, space 35 and ice-making chamber 60 may each be provided with adjustable automatic air

admission valves which may be spring or otherwise controlled, said valves opening at a predetermined pressure under the pressure of the external air and automatically closing again when the interior air pressure rises to a predetermined point.

The exhauster connections 42, 43 and 61 may be fitted with electrical heating means, such as resistance wiring in an electrical circuit for keeping the exhauster connections in a fit condition to exhaust the air, i.e. to prevent them from "frosting." The said circuit may include the automatic switches 54 and the electrical motor driving the exhauster so that the exhauster connections will be heated simultaneously with the setting in motion of the exhauster. The ends of the connections 42, 43 and 61 where they project into the chamber 33, space 35 and ice-unit 60 may be provided with wire grids or perforated metal covers for protection and the thermal switches 54 and all thermometers and gauges may also be provided with protectors to prevent them being broken or damaged.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A heat-insulated storage chamber or cabinet of the kind described having means which will permit air to be admitted to the surrounding wholly or partially evacuated space while maintaining the vacuum in the storage chamber.

2. A heat-insulated storage chamber or cabinet as claimed in claim 1, having thermally responsive means in the evacuated space surrounding the storage chamber adapted to automatically start the pump or exhauster, which is connected to the surrounding evacuated space, in the event of the temperature therein attaining or exceeding a predetermined temperature, and/or similar means in the storage chamber adapted to automatically start the pump or exhauster connected to said storage chamber when the temperature in said chamber rises to or above a predetermined temperature.

3. A heat-insulated storage chamber or cabinet as claimed in claim 1 or 2 having an inner wall forming the storage chamber and an outer wall spaced from and surrounding or partly surrounding the inner wall, the intermediate space being more or less evacuated by connecting it to an electrically, hand or otherwise operated pump or exhauster characterized in that the outer wall is fitted with an air inlet for directly admitting air through said outer wall to said intermediate space.

4. A heat-insulated storage chamber or cabinet according to claim [illegible] having an inner wall and an outer wall spaced from the inner wall, supports bridging said space, one or more lids, covers or doors fitted in each of said walls, a connection on the inner wall and another on the outer wall for connecting an exhauster for evacuating the space within the inner wall and the space between the inner wall and the outer wall, and an automatic valve in each of the exhauster connections adapted to close under atmospheric pressure.

5. A heat-insulated storage cabinet according to claim 1 having an inner wall, an outer wall spaced therefrom and an intermediate wall spaced from the inner and outer walls, supports bridging the spaces between the walls, exhauster connections to the space within the inner wall and to the space between the intermediate wall and the inner wall and, if desired, between the intermediate and the outer walls, an automatic valve in each of said connections adapted to close under atmospheric pressure and one or more lids, doors or covers in each of said walls for giving access to the space within the inner wall.

6. The combination with a heat-insulated storage cabinet according to claim 4 or 5 of an exhauster connected to each of the space or spaces to be evacuated and valves for controlling communication between the exhauster and said spaces.

7. A heat-insulated storage cabinet as claimed in claim 1, having an inner chamber formed by an inner heat-conducting wall, an airtight door at the front of said chamber, a shell spaced from said inner chamber, supports at intervals between said shell and the wall of the inner chamber, an outer casing, a non-conducting filling between said casing and shell, an outer door giving access through said casing and shell to the inner door, connections through said shell and casing from the inner chamber and the space around said chamber respectively to means for exhausting air from the inner chamber and its surrounding space, and an automatic valve in each of said connections, said valves being closed by atmospheric pressure.

8. A heat-insulated storage cabinet as claimed in claim 7, having a common conduit joining the connections from the inner chamber and its surrounding space, means for connecting said conduit to an exhauster for exhausting air through said connections from the inner chamber and its surrounding space, an air inlet branch to the common conduit, a two-way valve controlling said air inlet branch, a stop valve in the conduit for disconnecting the

inner cham[illegible]rom the exhausting means and an au[illegible]matic valve between the exhauster connection and said conduit, said automatic valve being closed by atmospheric pressure.

9. The combination with a heat-insulated storage cabinet as claimed in any of the preceding claims 6—8, of an electric motor for driving the exhauster, and automatic thermal switches fitted in the inner chamber and in its surrounding space respectively for closing the power circuit of the electric motor when the temperature of the inner chamber or its surrounding space has reached a predetermined degree.

10. The combination with a heat-insulated storage box or cabinet according to any of the pr[illegible]ng claims, of an ice-making unit b[illegible] in the upper part of the inner evacuated space or the surrounding evacuated space, or attached to the outside of the cabinet, said unit comprising a chamber, means for exhausting air from said chamber and a door giving access to the interior of said chamber.

11. A heat-insulating storage box or cabinet constructed substantially as herein described with reference to the accompanying drawings.

Dated this 18th day of December, 1931.

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Chartered Patent Agents,
41, St. Vincent Place, Glasgow, and
10, Stafford Street, Edinburgh.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1933.

[This Drawing is a reproduction of the Original on a reduced scale.]

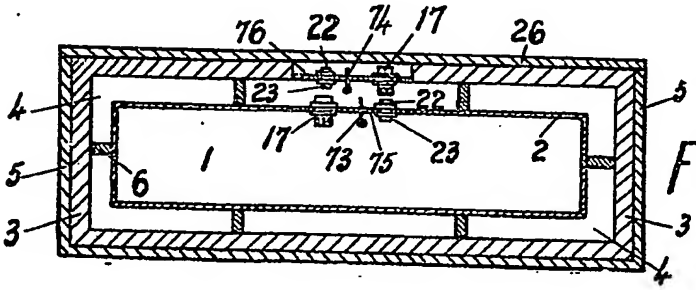


FIG. 1.

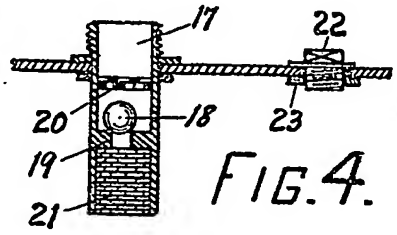


FIG. 4.

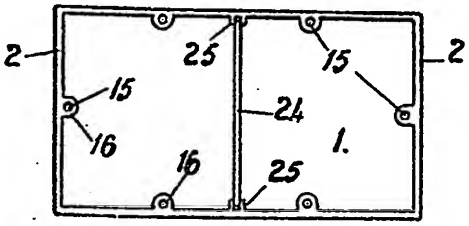


FIG. 2.

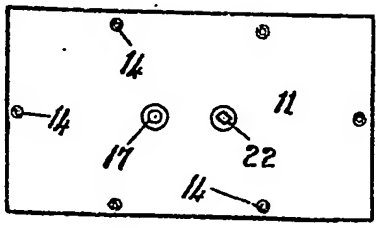


FIG. 3.

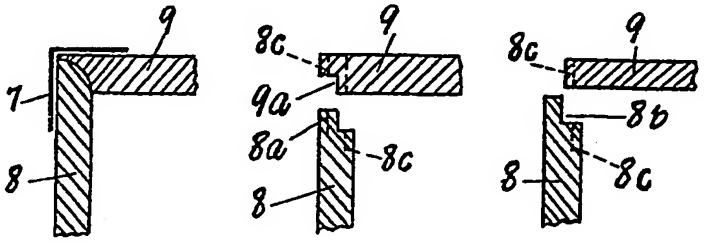
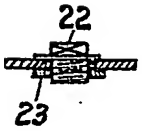


FIG. 5. FIG. 5a. FIG. 5b.



IG. 4.

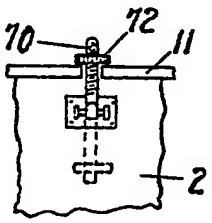


FIG. 6.

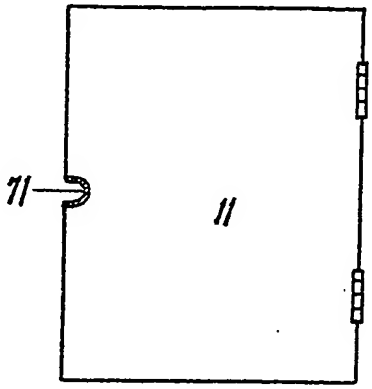


FIG. 7.

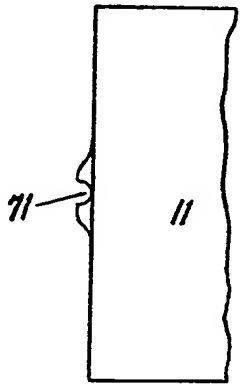


FIG. 8.

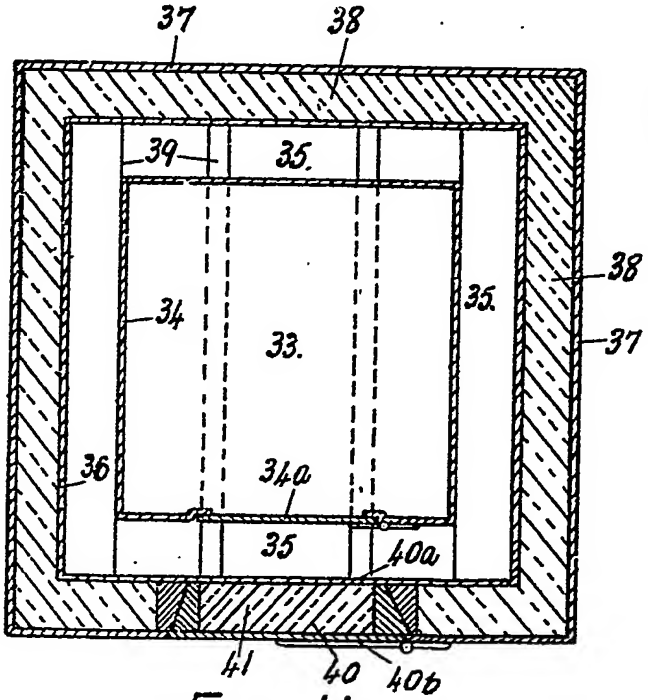


FIG. 11.

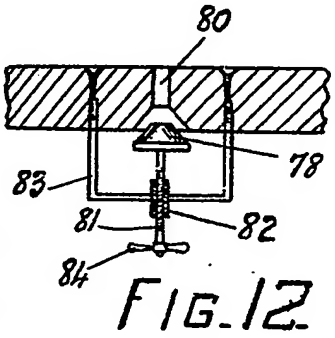


FIG. 12.

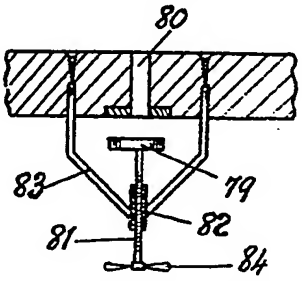


FIG. 13.

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[This Drawing is a reproduction of the Original on a reduced scale.]

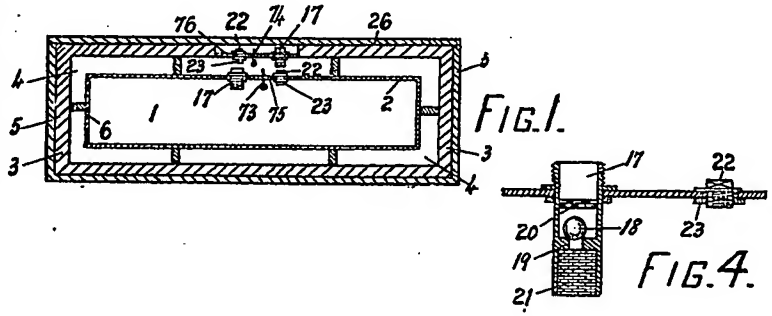


FIG. 1.

FIG. 4.

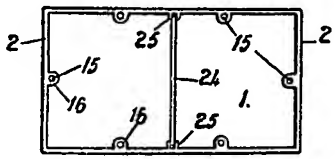


FIG. 2.

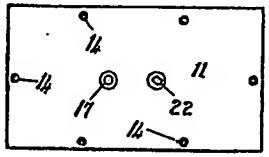


FIG. 3.

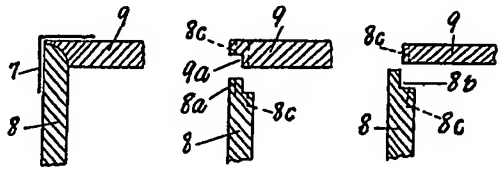


FIG. 5. FIG. 5a. FIG. 5b.

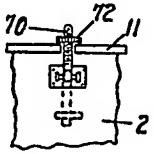


FIG. 6.

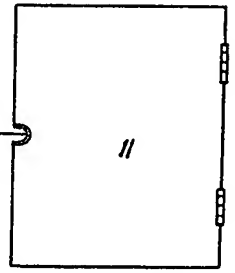


FIG. 7.

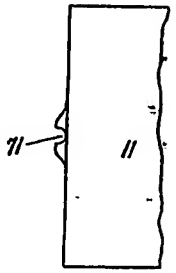
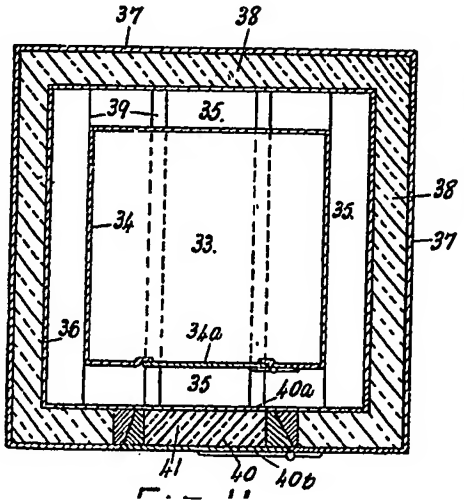


FIG. 8.



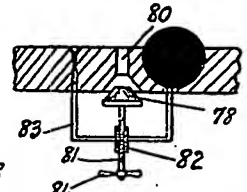


FIG. 12.

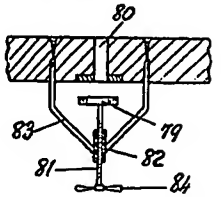


FIG. 13.

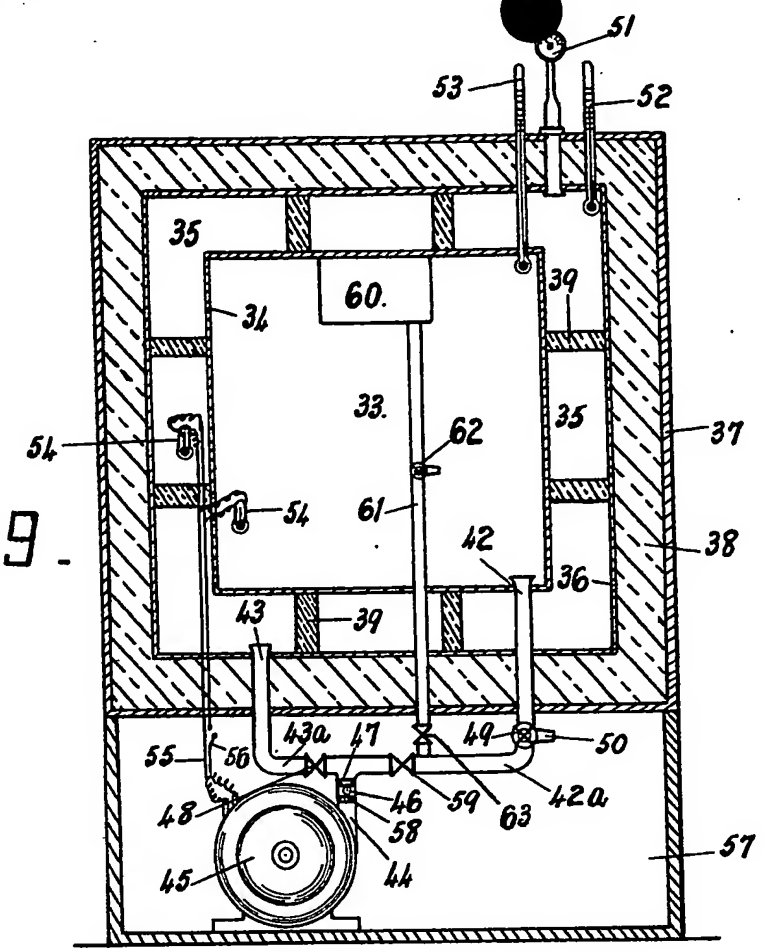


FIG. 9.

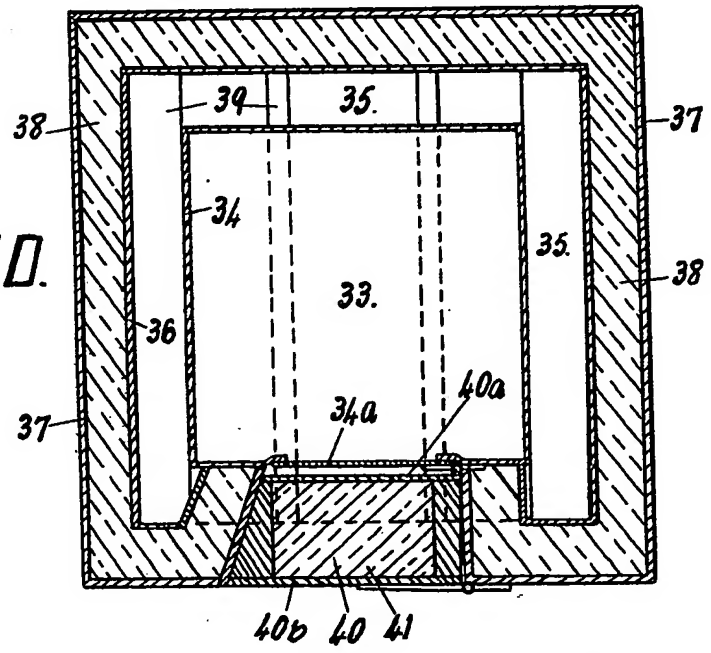


FIG. 10.

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